of the 27th. Warnings were hoisted at Chicago on the evening of the 25th, and were extended over the balance of the upper Lakes on the morning of the 26th. Verifying velocities were reported at several stations. Warnings were again ordered on the evening of the 29th for a disturbance of slighter energy which approached the Lake region from the British Northwest.

There were no snowstorms of consequence in any portion of the district during the month, and the temperature generally remained moderate, but cold-wave warnings were ordered for the Dakotas, Kansas, and Nebraska on the 16th, in advance of the cold weather following the first storm mentioned in the preceding paragraph. These warnings were verified in the northern sections, but the temperature over Kansas did not fall quite as low as was anticipated.—*Frank H. Bigelow, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

The month was colder than usual thruout the district, with an excess of precipitation in south-central Colorado and north-central New Mexico. In the extreme southern part of New Mexico the excess was the greatest on record for November. A cold wave visited the eastern slope on the 17th. No unusually low temperatures were experienced in the northern part of the Plains region, but south of the Arkansas-Platte divide there was a continuous fall for several days, zero, or lower, being reached in the extreme southeastern part of New Mexico.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month was usually dry, not more than half the normal rainfall being reported; few storms appeared on the northern coast or extended southward. Ordinarily November marks the beginning of the stormy period on the north Pacific coast, but this year the pressure distribution has been unfavorable for the normal storm movement. On the other hand, there has been a tendency for depressions forming over lower California and northwestern Mexico to move slowly northward over the Valley of the Colorado, with little, if any, easterly component of motion. In other words, there have been several cases where the disturbances appeared to be blocked in their eastern progress.

The month began with a disturbance on the Oregon coast which developed into a storm of marked energy. This caused high southeast winds and rain north of Point Conception. The storm was quite severe on the northern coast; warnings were displayed in ample time.

From November 5 to 14 the weather was clear and warm in California, under the influence of a succession of slow-moving high areas. During the latter half of the second decade unsettled weather prevailed, due to the passage of northern lows. During the third decade cold weather, with heavy frosts in the mornings, was reported generally in northern California. In southern California there was a succession of low areas, which apparently made but little progress eastward. High northerly winds resulted in the great Valley of California and along the coast. On November 30 a maximum wind velocity of 63 miles per hour from the northeast occurred at San Francisco. This is the highest wind velocity from the north which has ever been reported in this city.

Frosts have been unusually numerous for the month of November, notwithstanding high winds and dry conditions.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The first half of November was very stormy, and this district was visited by a succession of gales of unusual severity. Timely warnings were displayed in each case. The only casualty that occurred was the stranding just south of the mouth of the Columbia River of the British bark *Galena* on November 13. No lives were lost when this ship was wrecked, and the cause of the disaster was not so much on account of high winds as it was from fog and strong currents, whereby the navigating officer lost his reckoning and got into the breakers when he thought he was several miles away from them. A similar casualty occurred on October 25 (not previously reported) to the British bark *Peter Iredale*, which was wrecked on Clatsop spit during thick weather. No lives were lost, but the vessel became a total wreck.

The rains attending the storms of the fore part of the month were unusually heavy, especially in Washington, and all streams in that State between the 9th and 15th overflowed their banks and flooded the lowlands. The damage from floods was enormous, and it was several days before traffic was resumed over the railroads. Three or four lives were lost and large quantities of saw logs were swept away from their booms and never recovered. Many bridges, both railroad and county, were destroyed, and the damage in farming communities to fences, stock, and buildings was very great. In Oregon the rains were not so heavy; the rivers only became bank full, and little damage ensued. The last half of the month was generally fair and cooler with moderate but disagreeable east winds.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The only great flood of the month occurred in the North Pacific States, and mainly over the watersheds of the smaller streams where no river and flood service is maintained. The details regarding these floods were fully covered in the public press, and a brief mention of them is made in another part of this REVIEW. They were caused by the excessive rains during the first decade of the month, accompanied by high temperatures which rapidly melted the several feet of snow already on the mountain ranges.

The rise in the Columbia River was only moderate, but in the Willamette it was more pronounced, altho flood stages were reached only in the vicinity of Portland, Oreg., where a stage of 16 feet, or one foot above the flood stage, was reached on the 18th.

There were no other floods of consequence except in the Tennessee River. This flood was caused by the heavy snows of the 14th and 15th, the high temperatures of the 15th causing the rapid melting of the snows, together with the heavy rains from the 17th to the 19th, inclusive. At many places along the upper Tennessee River the stages reached exceeded all previous records for the month of November, and considerable damage was done by the rising waters. The following report on the flood over this portion of the Tennessee watershed was prepared by Mr. L. M. Pindell, official in charge of the local office of the Weather Bureau at Chattanooga, Tenn.:

On November 14 and 15 heavy snows prevailed over the entire Tennessee watershed from central Tennessee to Virginia. The snow varied in depth from 4 to 8 inches, and was the heaviest on record for the month of November. The ground was frozen and comparatively dry, and very little of the snow melted on the 14th. On the 15th the temperature began to rise, and the melting snow moistened the ground almost to the point of saturation. Rain began on the 17th, became heavy during the same evening, and continued until the 19th. A report for the 19th from Murphy, N. C., on the headwaters of the Hiwassee River, delayed twenty-four hours in transmission, stated that 8 inches of rain had fallen. McGhee, Tenn., on the Little Tennessee River, reported 4.74 inches, and Rogersville, Tenn., on the Holston River, 3.62 inches during the twenty-four hours ending at 8 a. m. of the 19th. All the precipitation that had fallen was finding its way into the river and tributaries. A careful study of the conditions justified a forecast of 25 feet at Chattanooga, Tenn., by the night of the 20th. At 7 a. m. of the 19th, the Clinch River had risen over 12 feet at Speers Ferry, Va., and was within 4.5 feet of the flood stage; an 18-foot rise was reported at McGhee, on the Little Tennessee, making the river over 2 feet above the flood stage, and a nearly 17-foot rise at Charleston, Tenn., on the Hiwassee, or within 2 feet of the flood stage. The rise at Clinton, Kingston, Tazewell, Knoxville, and Loudon, Tenn., varied from 7 to 8 feet.

Warnings of the sudden rise were promptly issued and given wide distribution, with the result that large quantities of lumber and other

property were secured and protected. Heavy rises occurred between 7 a. m. of the 19th and 7 a. m. of the 20th, varying from 14 feet at Chattanooga to 11 feet on the Clinch and Powell rivers. A stage of 32 feet was forecast for Chattanooga by the night of the 21st, and the information widely disseminated. Local interests were warned to prepare for a crest stage of a little over 33 feet during the night of the 21st. Numerous calls by telephone from parties up and down the river were promptly answered and full information and forecast given. A crest stage of 23 feet was forecast at Bridgeport, Ala., and 29 feet at Guntersville, Ala.; the actual crests were 23.4 feet at Bridgeport, 0.6 foot below the flood stage, and 29.8 feet at Guntersville, 1.2 feet below the flood stage. The river at Chattanooga reached its crest of between 33.3 and 33.4 feet after 12:35 a. m. of the 22d, and the first fall was recorded at 12:20 p. m. of the 22d. The crest stage exceeded all previous November records by a little over 3 feet. The back water caused considerable inconvenience at and below Chattanooga by covering public roads and by stopping various sawmills and other industries near the river. No property was lost, as far as can be ascertained, at or below Chattanooga. Above Chattanooga, on the headwaters of the Ocoee and Hiwassee rivers, much damage was done. Thousands of bushels of corn were damaged and pumpkin fields were completely washt away. The drift that passed Chattanooga was heavy, consisting of logs, pumpkins, large trees, straw, bridge timber, dead hogs, chickens, etc. The Louisville and Nashville Railway bridge at Reliance and the Isabella trestle were washt away on the afternoon of the 19th. A cloud-burst on the afternoon of the 18th on Thunderhead Mountain washt away about 25 miles of track of the Little River Lumber Company, near Townsend, causing a loss of nearly $50,000. The Philadelphia Veneer and Lumber Company lost $8,000 worth of logs at Clinton, Tenn., and the Tellico Lumber Company, at Tellico Plains, lost a large number of logs. It was reported that twenty lives were lost at McCays station, on the Knoxville and Marietta branch of the Louisville and Nashville Railway, but later information reduced that number to three. The persons lost were warned to move, as the river was rising rapidly, but they paid no attention to the warning, and within three hours they were swept away, with their cabin.

Warnings were also issued at the proper time for the lower Tennessee River, where the crest stages varied from 1 foot to 4 feet above the flood lines.

The crest of the Ohio River rise reached Cairo, Ill., on the 27th, and at the end of the month the Mississippi was rising steadily below Memphis, Tenn. In the vicinity of Paducah, Ky., the high water caused damage to the amount of about $50,000, altho the highest point reached by the river was over 7 feet below the flood stage. The losses were due to the fact that the rise was a most unusual one for the month of November, when low-water stages are the rule, and much stock and lumber had accordingly been left on the lands subject to overflow. It has been stated, however, that the losses would have been more than doubled had it not been for the warnings issued in advance of the flood.

The Milk River at Havre, Mont., froze over on the 15th and the James at Huron, S. Dak., on the 17th. The Missouri was still open at the end of the month from Bismarck, N. Dak., southward, altho heavy floating ice was observed at Bismarck on the 18th. There was a small gorge at Sioux City, Iowa, on the 20th, and floating ice as far south as Kansas City, Mo., from the 22d to the 28th, inclusive.

The first ice in the Mississippi River was observed at Fort Ripley, Minn., on the 17th. Floating ice was also seen on the 23d at Prairie du Chien, Wis., but none below that point.

The highest and lowest water, mean stage, and monthly range at 281 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure for November, 1906, over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

The mean atmospheric pressure was above the normal over all sections of the United States and Canada except the extreme southwest, along the Gulf coast, and over New England and the Canadian Maritime Provinces.

Over the interior portion of the United States from the Rocky Mountains eastward, pressure averaged unusually high, due in the main to the slow passage eastward of several well-defined areas of high pressure during the early part of the month. Pressure averages for the month were decidedly below the normal, —.05 to —.15 inch, from New England northeastward over New Brunswick and Nova Scotia.

Over the north Pacific coast and adjacent territory the almost continuous low pressure during the early part of the month gave way during the second decade, and unusually high pressure prevailed over that section during the remainder of the month.

TEMPERATURE.

From the Rocky Mountain slope eastward to the Atlantic the monthly mean temperature averaged above the normal, except over eastern New York and northern New England, where slight deficiencies were noted. Over the lower Mississippi Valley the excess of temperature was marked, averaging about 5° daily above the normal in the southern portions of the States of Alabama, Mississippi, and Louisiana.

Temperatures along the northern border were generally above the average, especially over the upper Lake region, and under the influence of the prevailing southerly winds from the high pressure over the central part of the United States the positive departures in Canada from the Lake region to Manitoba and northward showed marked increases.

From the Rocky Mountains west to the Pacific coast, except over small sections of northern California and western Oregon, the temperature was generally below the seasonal average. Over southwestern Utah, southern Nevada, and southeastern California, the month was an unusually cold one.

Maximum temperatures of 90°, or above, were recorded in southwestern Arizona and southeastern California and over the southern portion of Texas. Maximum temperatures of 80° to 90° were confined principally to the Gulf States.

Severe cold was experienced over the lower Mississippi Valley and east Gulf States from the 12th to the 14th, and freezing temperatures prevailed over the interior of that section with killing frosts almost to the Gulf coast. Unusually cold weather prevailed over California during the latter part of the month with heavy to killing frosts in many portions of the southern part of the State.

Minimum temperatures from 10° to 25° below zero were recorded over North Dakota and in the central Rocky Mountain districts during the progress of an extensive area of high pressure southeastward over the Great Plains and central valleys from the 18th to the 20th.

PRECIPITATION.

The precipitation during November is usually heavy, above 4 inches, over the lower Mississippi Valley, and on the Pacific coast from central California northward over the district west of and including the Coast Range of mountains, and, including the higher elevations of the Cascades, where monthly amounts from 10 to 15 inches are frequently recorded.

Precipitation is usually light, less than 1 inch, over southern California, the Rocky Mountains, and the Great Plains, and comparatively light over the Florida Peninsula.